Agenda - Executive Policy Committee - July 14, 2004

Report - Standing Policy Committee on Public Works - July 6, 2004

Item No. 2 Water Treatment Plant Design Capacity Assessment
File WS-7

STANDING COMMITTEE RECOMMENDATION:

On July 6, 2004, the Standing Policy Committee on Public Works concurred in the administrative recommendation and submits the following to Council:

1. That the water treatment plant (WTP) design capacity be set to provide a treated water capacity of 400 million litres/day (ML/d).

2. That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing.

Agenda - Executive Policy Committee - July 14, 2004

Report - Standing Policy Committee on Public Works - July 6, 2004

DECISION MAKING HISTORY:

STANDING COMMITTEE RECOMMENDATION:

On July 6, 2004, the Standing Policy Committee on Public Works concurred in the administrative recommendation and submitted the matter to the Executive Policy Committee and Council.

RE: WATER TREATMENT PLANT DESIGN CAPACITY ASSESSMENT

FOR SUBMISSION TO: Standing Policy Committee on Public Works

ORIGINAL REPORT SIGNED BY: Director of Water and Waste

REPORT DATE: May 26, 2004

RECOMMENDATION(S):

That the water treatment plant (WTP) design capacity be set to provide a treated water capacity of 400 million litres/day (ML/d).

Report Summary

KEY ISSUES:

- Engineering reports on the new water treatment plan were based on a capacity of 515 ML/d to satisfy projected water demands to 2028.

- A reduction in the WTP capacity to 400 ML/d may reduce the project cost by an estimated $20 million.

- If the WTP is designed to deliver 515 ML/d, there is no projected risk that a capacity shortfall will occur through to 2028. If the capacity of the WTP is reduced to 400 ML/d, there is a small risk that the City will have to impose water use restrictions during drought conditions. The risk that some minor amount of water rationing would be required would be about 2% per year at the time of start-up of the WTP, and would increase to just about 5% per year by 2028.

IMPLICATIONS OF THE RECOMMENDATION(S):

General Implications

	None
	For the organization overall and/or for other departments
X	For the community and/or organizations external to the City of Winnipeg
	Involves a multi-year contract

Comment:

- The water use restrictions, which may be required during drought conditions for a WTP capacity of 400 ML/d, would not have significant economic consequences. Measures

such as a reduction in lawn watering and vehicle washing may be necessary. The financial implications are not likely to be significant, and would be less than the annualized cost savings resulting from the capacity reduction. The cost of preparing an operations model and a water demand management plan to ensure that the City is prepared for such an event would be in the order of $150,000.00.

Policy implications

X	No
	Yes

Comment:

Environmental Implications

X	None
	Yes

Comment:

Human Resources Implications

X	No
	Yes

Financial Implications

X	Within approved current and/or capital budget
	Current and/or capital budget adjustment required

Comment:

- Future capital and current budgets will be adjusted as project cost estimates are more fully developed.

Report

REASON FOR THE REPORT:

To advise Council of the risk of experiencing water restrictions and cost savings associated with the proposed water treatment plant capacity.

HISTORY:

1993 Council approved the creation of the Water Treatment Reserve Fund to cash finance a portion of the cost of a water treatment plant.

2000 On November 22, Council adopted the following recommendations:

1. The City proceed with treatment of the water supply as described herein.
2. Design and construction activities be undertaken so that the water treatment plant be operational in the year 2006.
3. That the water treatment process as identified through the pilot testing and described herein be adopted as the baseline process for comparison to alternatives and new technologies.
4. The Administration:
a) Investigate and report on emerging technologies such as ultraviolet disinfection and membranes;
b) Investigate and report on alternative project delivery strategies;
c) Prepare documents in support of any application by Council for Federal and Provincial funding.

2002 On July 17, Council adopted the following recommendations:

1. That the baseline water treatment process approved by Council be amended to include ultra violet (UV) light disinfection.
2. That the schedule for implementation of water treatment approved by Council be amended to facilitate staged implementation, with construction of a UV disinfection facility to be operational in 2004, construction of a chloramination facility to be operational in 2005, and construction of the balance of the water treatment plant to be operational in 2007.
3. That membrane filtration not be considered for water treatment in Winnipeg, due to the high cost of the technology.

2003 On June 25, Council adopted the following recommendation:

It is recommended that the "construction management" project delivery strategy be utilized for design and construction of the water treatment plant, and that City forces operate the facility.

DISCUSSION:

The conceptual design and cost estimate of the WTP was based on a finished water production capacity of 515 ML/d, to satisfy projected water demands to 2028. A WTP Value Engineering (VE) Study was completed in February 2003. The purpose of the VE Study was to review the Conceptual Design with the objective of optimizing the sizing, process or construction methods to increase value for money spent. One of the key VE Proposals was to revisit the WTP capacity in light of reduced water demands experienced in Winnipeg in recent years. The VE proposal recommended that a revised WTP capacity in the range of 350-400 ML/d be considered. It was estimated that this could result in capital cost savings of $20 - $30M. The VE Team also identified that surplus storage capacity at the Regional Pumping Station reservoirs (MacLean, McPhillips and Wilkes) could be utilized during periods when water demands exceed the WTP capacity, thereby largely mitigating WTP capacity shortfalls. Based upon these recommendations further study was undertaken to evaluate the risks and benefits of reducing the capacity of the WTP.

Water Demand Projection:

The department uses a computer model to project future water consumption. Population projections and the projected use of water efficient fixtures have a significant bearing on projected water consumption and are key inputs to the water projection model. The computer model used for the Conceptual Design undertaken in 1998 projected that water demand would remain relatively constant until present. Recorded demands have in fact declined slightly. This is explained by the fact that population is growing at a slower rate than was projected in the model, and there has been a higher than anticipated use of water efficient fixtures.

Since the 1998 water demand projection, one additional Census was completed in 2001. This Census data became available in late 2003. The most recent population data indicates that Winnipeg's population did not grow at the expected rate. The current population forecast furnished by the CAO Secretariat is shown in Table 1 below, along with the 1998 projection and historical data. The current population forecast will not reach the levels predicted in the 1998 forecast until circa 2022. Population is the most sensitive variable in determining water consumption and predicting future water demands.

Table 1: Population Trends

Year	Historical Data	1998 Projection	2003 Projection*
1994	626,632		
1996	630,612		
1998	631,047	638,084	
2000	631,482	643,831	
2002	634,940	655,164	
2004		662,773	641,420
2006		665,608	647,900
2008		671,307	655,100
2010		677,006	662,300
2012		680,637	670,000
2014		685,646	678,200
2016		691,751	686,400
2018		697,199	695,600
2020		702,646	704,800
2022		709,479	709,479
2024		715,389	715,389
2026		720,453	720,453
2028		726,025	726,025

* Source: City of Winnipeg CAO Secretariat

The second most sensitive variable in the water demand projection model is the rate at which high water use fixtures are replaced with modern low water efficient fixtures. In residential homes, the key water consuming fixtures affecting current water demands are ultra low flush toilets (6 Litres/flush), low flow shower heads and new front load laundry machines.

Within the last decade, regulatory initiatives have mandated low flush toilets in many jurisdictions throughout North America. As a result, local and national suppliers are now carrying water efficient fixtures. In Winnipeg, 6 & 13 litre flush toilets are available.

In general, as a result of more water efficient fixtures being sold and installed, the price premium of such fixtures is such that it is advantageous for homeowners to purchase water efficient fixtures.

A majority of the homes in Winnipeg were constructed with toilets that use 23 litres per flush. As home renovations take place, these fixtures are replaced with new more water efficient fixtures. Approximately 36% of the residential home indoor water use is attributed to the toilet, which results in considerable water savings when replaced with a 6 litre flush toilet. The front load laundry machines are also having a water savings impact. These machines typical use 40% less water than standard top load washers. The standard washing appliance consumes approximately 18% of the water used in a residential home.

The lower than projected per capita use of water in Winnipeg reflects a higher than projected use of water efficient fixtures.

The revised population projections and expected use of water efficient fixtures were used to update the water projection model to generate new consumption forecasts.

Water Treatment Design Capacity:

After determining a projected water demand for 2028, an assessment was made of the variability in water demands. The method utilizes a risk-based model, in which actual past water demand patterns of peaks and durations are used to simulate the future design requirements. 50 years of historical water demand patterns were used to assess the likelihood of water shortages for different water treatment plant capacities of 350, 385, 400 and 480 ML/d. Available surplus regional reservoir capacity was utilized as part of this analysis.

Figure 1 charts risk against WTP capacity. If the WTP were sized for 480 ML/d there is virtually no risk of water demands exceeding the capacity of the water treatment plant for the demand conditions forecast in 2028. As the plant capacity is reduced, the risk of water restrictions begins to increase. The rate at which risk increases is very gradual to a capacity of 400 ML/d. As the WTP capacity is reduced further, the rate of risk begins to increase more rapidly. A 400 ML/d WTP carries a 4% risk (once every 25 years) of water restrictions. A 350 ML/d WTP carries a risk slightly above 20% (once every 5 years). This 20% frequency of water rationing would be a significant inconvenience to consumers, and could result in the need to aggressively manage future water demands should the economic activity and population growth exceed the current water demand projection.

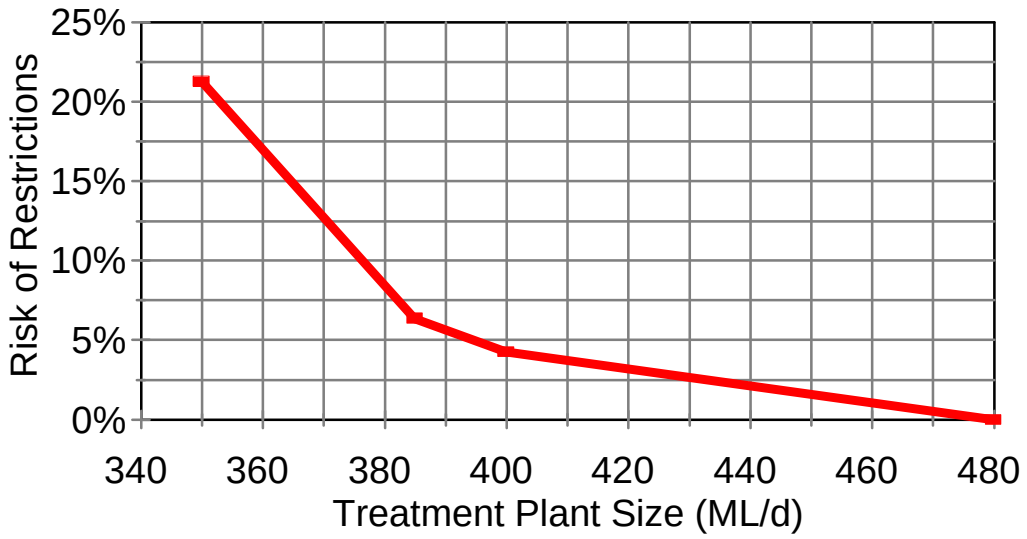

Figure 1: Probability of Water Restrictions Being Required in 2028

A WTP with a capacity of 400 ML/d has a low probability of a capacity shortfall in any one year (< 5%) and could provide an estimated $20 million capital cost saving. A design capacity of less than 400 ML/d significantly increases the probability of a capacity shortfall, without commensurate cost savings.

Accordingly, a WTP capacity of 400 ML/d is recommended.

In order to mitigate the potential for water rationing and ensure desired results if rationing is required, a monitoring program, predictive modeling tool, demand management strategies and appropriate operating protocols must be implemented, at an estimated cost of $150,000.00.

Estimated Construction Costs:

The budget cost of $214 million currently being carried for the WTP was developed through a detailed costing exercise undertaken in 1999. At that time, construction estimates took total market conditions into consideration and applied inflation to the projected year of construction.

Due to the increase in large construction projects currently underway and being proposed within the near future in Manitoba, such as the MB Hydro office tower, MB Hydro Waskwatim dam, Winnipeg Floodway expansion and major improvements to the City's wastewater treatment systems; there is price uncertainty at this time. Material prices have increased sharply due to high world demand and limited supply. The WTP cost estimate will be reviewed in detail by the Construction Manager, whose services will be retained within the next 4 months. The Construction Manager will validate the WTP cost estimate based on current construction market conditions and for the recommended reduced capacity of 400 ML/d. The Capital Budget Estimate will be adjusted in the future as the project cost estimate is more fully developed. Reducing the WTP capacity to 400 ML/d will reduce the material quantities; however, whether the unit prices remain as projected in the cost estimate is yet to be validated given the current economic activities in Manitoba.

FINANCIAL IMPACT:

The following financial impact statement for this project has been prepared in accordance with the recommendation adopted by Council on December 13, 2000.

Financial Impact Statement **Date:** May 21, 2004

Project Name: Water Treatment Plant Design Capacity Assessment

COMMENTS:

The Capital Budget will not be adjusted at this time due to uncertainty in construction conditions which may impact the construction cost estimate.

Moira L. Geer C.A.
Manager of Finance & Administration

6018

In Preparing This Report There Was Consultation With And Concurrence By: N/A

This Report Submitted By:

Department: Water and Waste
Division: Engineering
Prepared by: Duane Griffin
File No. 020-18-29-05-00

G:\WTP\Design Capacity\Water Treatment Plant Capacity Report - March 2004-rev.doc